Lasers in Surgery and Medicine 25:435–437 (1999)

Conventional Instrument vs. Laser-Assisted Arthroscopic Meniscectomy

David E. Yakin, MD,[1]* and Vincent P. Rogers, MD[2]

[1]West Tennessee Orthopedic and Sports Medicine (DC), Jackson, Tennessee 38301
[2]Hamot Medical Center, Erie, Pennsylvania 16501

Background and Objectives: **Lasers have been advocated for use in arthroscopy; however, results do not show significantly different outcomes from conventional instrument arthroscopy. This study assesses outcomes and cost to patients treated with conventional arthroscopic instrumentation vs. holmium laser.**
Study Design/Materials and Methods: **Sixty-seven men and 26 women, average age 41 years (range, 15–76 years), were divided into two groups: patients who underwent conventional arthroscopic partial meniscectomies (43 patients) vs. those who underwent the procedure with holmium:yttrium-aluminum-garnet laser (50 patients). Hospital and clinic records were reviewed for demographic data, medical and operative histories, operative data, and follow-up examinations. Tourniquet time, range of motion, effusion, pain, and total cost were compared.**
Results: **No significant differences existed in range of motion and effusions between the two groups. The mean cost of conventional arthroscopic partial meniscectomy was significantly lower, at $1,102 (range, $538–1,586) vs. laser arthroscopic partial meniscectomy, at $1,536 (range, $851–2,894) ($p < 0.001$). Each patient of the laser group was billed an additional $420 to offset the rental of laser equipment (value, $150,000). All other costs in the laser and conventional groups were similar.**
Conclusion: **We recommend conventional arthroscopic instrumentation for routine partial meniscectomy. Lasers Surg. Med. 25:435–437, 1999.**

Key words: arthroscopy; laser

INTRODUCTION

The introduction of laser technology into the medical field has produced rapid advances in various specialties [1–3]. However, laser use in orthopedics has developed more slowly. For several years, lasers have been used to assist in arthroscopy [3–5]. Several authors advocate laser use in arthroscopic surgery, although outcomes are not statistically different from those using conventional instrument arthroscopy [4,6]. These authors report that the laser saves time and also results in less postoperative effusion compared with surgery using conventional arthroscopic instruments.

The laser's main advantage is its small size, facilitating access to tight spaces. Fanton and Dillingham [4] also reported less "scuffing" of articular cartilage using the holmium:yttrium-aluminum-garnet (Ho:YAG) laser; however, they did not report significant differences in outcomes. One disadvantage is the estimated $150,000 cost of the laser equipment.

This study compares outcomes, operative times, and overall cost to patients undergoing partial meniscectomy with conventional arthroscopic instrumentation vs. those treated with the Ho:YAG laser.

*Correspondence to: David E. Yakin, M.D., West Tennessee Orthopedic and Sports Medicine (DC), 544 Roland St., Suite A, Jackson, TN 38301.

Accepted 25 May 1999

TABLE 1. Frequency of Distributions of Injuries

	Conventional		Laser	
Injury	Frequency	Percent	Frequency	Percent
Medial				
Unspecified	7	16	10	20
Radial	21	49	22	44
Bucket handle	8	19	10	20
Posterior horn	0	0	2	4
Lateral meniscus tear				
Unspecified	3	7	1	2
Radial	3	7	3	6
Bucket handle	1	2	0	0
Posterior horn	0	0	2	4
Total	43		50	

MATERIALS AND METHODS

Records of 300 consecutive arthroscopic meniscectomies performed from June 1990–November 1994 in a large 499-bed medical center in northwestern Pennsylvania were reviewed. All operations were performed by a single surgeon. Patients who underwent a single partial meniscectomy were selected for further study. Patients with additional diagnoses of some form of arthritis or concomitant ligamentous injury, or chondral or osteochondral defect, were excluded from the study. The study population comprised 67 men and 26 women, average age of 41 years (range, 15–76 years). Eighty meniscectomies involved lesions of the medial meniscus, and 13, lesions of the lateral meniscus (Table 1). Though the extent of the meniscal tear was not defined (there was no way to determine this before surgery, and intraoperative reports were poor), all tears were treated similarly. Large tears were treated in the same manner as small tears.

Preoperatively, patients were assessed by physical examination, radiographs, and magnetic resonance imaging (MRI), as appropriate. MRI was utilized when results of prior examinations were ambiguous. Approximately 50% of patients required MRIs.

Because of the large capital investment for the laser equipment ($150,000), the medical center decided to rent the device. Laser patients were billed an extra $420 per procedure for use of the device. All other costs associated with laser vs. conventional surgery were similar.

The patients were divided into two groups: 43 who underwent arthroscopic partial meniscectomy with conventional instruments and 50 treated with Ho:YAG laser (all arthroscopic meniscectomies performed between August 1992–November 1993 utilized the laser). The hospital and clinic records were reviewed for demographic data, medical and operative histories, and follow-up examination. Information on preoperative muscle status of the patients was unavailable.

Diagnosis

Methods of preoperative assessment included physical examination, roentgenogram, and MRI, if indicated.

Technique

In each case, before insertion of the arthroscope, a tourniquet was inflated after exsanguination of the limb. After the patient's dressing was secured, the tourniquet was deflated at the close of the procedure. Since this was performed in the same manner for each case, tourniquet time was used as an assessment of operative time.

The same postoperative protocol was followed for each patient. This included daily range-of-motion (ROM) and open chain quadriceps-strengthening exercises three times per week for 1 month. The patients were allowed to weight-bear as tolerated and returned for follow-up examination at 1-week and 4-week intervals. ROM was assessed at the 4-week follow-up visit. Effusion and pain were each evaluated at all follow-up visits and were graded as 0, none; 1, mild; 2, moderate; and 3, severe.

After the acute postoperative period, patient prescriptions were changed from narcotics to antiinflammatory medications that were taken as needed for 1 month. After 1 month, patients were discharged without medication. In general, patients were discharged when they returned to their previous level of function.

Finally, the cost of each procedure was determined and recorded for each patient. A Kruskal-Wallis test was used to analyze effusion and pain data. t-tests were utilized to compare tourniquet times, ROMs, and total costs.

RESULTS

No statistically significant difference existed in the mean ROM in the conventional group (0–133°) vs. the laser group (0–135°). Pain and effusion ratings were also similar (Tables 2, 3).

The mean tourniquet time was 3.2 min less for the conventional group vs. the laser group (27.3 ± 6 min vs. 30.5 ± 8 min) ($p < 0.05$). The mean cost of conventional arthroscopic partial meniscectomy was $1,102 (range, $538–1,586) vs.

TABLE 2. Pain Ratings at One-Month Follow-Up

Rating	Conventional	Laser
0	76.7% (33/43)	74.0% (37/50)
1	16.3% (7/43)	24.0% (12/50)
2	7.0% (3/43)	2.0% (1/50)
3	0.0% (0/43)	0.0% (0/50)

TABLE 3. Effusion Ratings at One-Month Follow-Up

Rating	Conventional	Laser
0	74.4% (32/43)	90.0% (45/50)
1	23.3% (10/43)	6.0% (3/50)
2	2.3% (1/43)	0.0% (0/50)
3	0.0% (0/43)	4.0% (2/50)

laser arthroscopic partial meniscectomy, at $1,536 (range, $851–2,894). This difference was highly significant ($p < 0.001$).

DISCUSSION

Reports indicate that the laser offers the advantage of ease of manipulation in small spaces [4,6]. We also found the laser much easier to manipulate in the posterior-horn region. Although this would seem to offer a time-savings as stated by Lane et al. [6], our laser tourniquet times were actually an average of 3 minutes longer when compared with conventional surgery ($p < 0.05$). Though interesting, this 3-minute increase is probably not clinically significant.

Another reported advantage of laser use is less articular surface "scuffing." Fanton and Dillingham [4] reviewed 51 cases of isolated meniscal lesions in which resections were performed with a Ho:YAG laser vs. conventional mechanical instrumentation. These authors reported that the laser was easier to use than mechanical instruments and that scuffing of articular cartilage occurred in fewer patients. In their study, scuffing was noted in 72% (19/26) of the conventionally treated patients, but in only 11% (3/26) of the laser-treated patients [4].

Less scuffing would appear to be advantageous; however, the difference in "scuffing rates" between the laser vs. mechanical instrumentation in long-term clinical outcomes remains undetermined.

Although Fanton and Dillingham [4] reported a tendency toward decreased pain and shorter recovery of ROM in the early postoperative period, results did not achieve statistical significance. Our results show that no statistically significant differences existed in either pain or ROM recovery in the two groups. The pain rating was 0 in 77% of the patients who underwent conventional surgery vs. 74% in the laser group. Only 23% of the conventional and 26% of the laser group reported mild pain. Because of the success rate of conventional arthroscopy, achieving statistical significance with the laser would be difficult.

Another advantage offered by the laser is that of hemostatic capability. Fanton and Dillingham [4] reported that patients treated with the laser experienced less postoperative effusion compared with those treated by mechanical instrumentation alone. In our study, a tendency for less postoperative effusion (rating = 0) was observed in the laser-treated group vs. the conventional group (90% vs. 74%, respectively); however, this did not reach statistical significance. Of note, the laser was 40% more expensive than the conventional technique (average, $1,536 vs. $1,102) ($p < 0.001$). The additional cost was reflective of the per-patient charge of $420 for use of the laser equipment.

Our study demonstrates that though routine laser-assisted partial meniscectomy may offer some minor advantages over the conventional technique, it is not cost-effective.

CONCLUSIONS

No statistically significant differences were observed in any of the outcome measures, except tourniquet time, which was shorter during conventional surgery. Since the laser was 40% more expensive than conventional surgery, we recommend conventional arthroscopy for routine partial meniscectomy.

REFERENCES

1. Abstein GT, Jaffe SN, eds. Lasers in medicine: an introductory guide. London: Chapman & Hall; 1989.
2. Andrews H, Polanyi TG, editors. Microscopic and endoscopic surgery with the CO_2 laser. Boston: John Wright; 1982.
3. Sherk HH, ed. Lasers in orthopaedics. Philadelphia: Lippincott; 1990.
4. Fanton GS, Dillingham MF. The use of the holmium laser in arthroscopic surgery. Semin Orthop 1992;7:102–116.
5. Metcalf RW, Dixon JA. Use of lasers for arthroscopic meniscectomy. A preliminary report on laboratory investigations. Lasers Surg Med 1984;3:305–369.
6. Lane GJ, Sherk HH, Mooar PA, et al. Holmium:YAG laser versus carbon dioxide laser versus mechanical arthroscopic debridement. Semin Orthop 1992;7:95–101.